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A Review on Mandookaparni

M.P.Kabra^{1*}, S.S. Bhandari¹, M.K.Vaishnav¹, R.B.Gupta¹

1.Dept. of Pharmacology, Kota College of Pharmacy, Kota (Rajasthan.)

ABSTRACT

Centellaasiatica of the family Umbelliferae is commonly found in the parts of India, Asia and Middle East & commonly known as Mandookaparni. It is a perennial, herbaceous creeper growing upto 30 cm in height with fan-shaped leaves. It contains glycosides, alkaloids and triterpine acids. Toxicological study of asiaticoside showed that subcutaneous injection of asiaticoside in doses of 0.04 to 0.05 gm / kg in rat and rabbit was found toxic. The oral dose of 1 gm / kg was well tolerated. The plant is bitter, acrid, sweet, cooling, soporific, cardiogenic, nervine tonic, stomachic, carminative, antileprotic, diuretic and febrifuge. It is used as a brain tonic for promoting brain growth and improving memory. Ayurvedic medicines has effectively used it in the treatment of inflammation, anemia, asthma, blood disorders, bronchitis, fever, urinary discharge and splenomegaly. Reported activity of *Centellaasiatica* are cardiovascular activity, antioxidant activity, antimicrobial activity, antifilarial activity, anxiolytic activity, antidiabetic and antihyperlipidemic activity, radioprotective activity, antiproliferative activity, anticonvulsant activity, memory enhancement activity, antinociceptive activity, anti-inflammatory activity, antiulcer activity, antifertility activity, antitumor activity, wound healing activity and anti-immune activity.

Keywords: *Centellaasiatica*, Mandookaparni, Asiaticoside, Brain tonic.

*Corresponding Author Email: sanskarkabra@gmail.com

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INTRODUCTION

Botanical Name: *Centellaasiatica* (Linn.) Urban

Synonym:Hydrocotyleasiatica Linn.

Classical Names: Mandooki, Mandookaparni, Divya, Mahaushadhi, Twashtri.

Vernacular Names:

Eng.	–	Indian pennywort;
Hindi	–	Brahmamanduki, Brahmibhed, Bengsag, Khulakhudi;
Beng.	–	Thankuni, tholkuri;
Guj.	–	Motibrahmi, khadbrahmi;
Kan.	–	Urage, Vondelaga;
Mal.	–	Muttil, Kutannal, Kutakan;
Mar.	–	Karinga, karivana;
Tam.	–	Ballau, Vallarai;
Tel.	–	Brahmi, Mandukbrahmi, Saraswataku;
Assam	–	Manimumi;
Bihar	–	Chokiora;
Meghalaya	–	Batmaina;
Tripura	–	Thankuni, Thunimankuni.

Classification

Kingdom	:	Plantae
Division	:	Angiospermae
Class	:	Dicotyledonae
Order	:	Umbelliferae
Family	:	Apiaceae
Genus	:	Centella
Species	:	Asiaticalinn.

Distribution

Throughout India, up to an altitude of 600 m. recently reported to be rare and threatened in Gujarat¹.

Propagation and Cultivation

It is propagated from seeds or stolons and can be grown on the variety of soils. However moist locations are more suitable. It can be grown in the shady places as well¹.

Parts used: Whole plant.



Fig.*Centella asiatica*

Botanical Description

Macroscopic :

Small creeping herb with slender stem, rooting at nodes giving rise to thin, brownish-grey, roots of about 2.5 to 6.0 cm in length; leaves 1 to 3 from each node, orbicular-reniform, crenate, base cordate, petioles chanelled with adnate stipules; flowers fascicled umbels each carrying 3 or 4 flowers, short stalked; fruits cremocarp, ovoid with laterally compressed seeds¹.

Microscopic :

Root –

Shows wavy outline, consisting of 3 or 5 layered, rectangular, cork cells having exfoliated cells, followed by 3 or 4 layers of parenchyma cells containing oval to round, simple starch grains having centric hilum and microsphenoidal crystals of calcium oxalate; secondary cortex composed of thin walled, secretory cells present, pith nearly obliterated¹.

Stem –

More or less concave-convex outline, shows single layered epidermis composed of round to cubical cells covered by striated cuticle; below this 2 or 3 layers of collenchymatous cells, followed by the 6 or 8 layers of thin-walled, parenchymatous cells with intercellular spaces present; resin duct present in the parenchymatous cells of cortex and generally one in between vascular bundles¹.

Leaf –

Petiole –

Shows a characteristic outline due to two projections adjacent to ventral groove; epidermis single layered, cells cubical covered by a thick cuticle; collenchyma 2 or 3 layered, absent on the

projections and a few containing the rosette crystals of calcium oxalate; and vascular bundles are seven in numbers.

Midrib –

Shows a single layered epidermis, 2 or 3 layered collenchyma on both surfaces, larger on the upper surface, 4 or 5 layered parenchyma, central zone consist of vascular bundles.

Lamina –

Shows an epidermis of tangentially elongated cells on both surfaces, larger on the upper surface, covered by the striated cuticle mesophyll differentiated into 2 or 3 layers of palisade cells, 5 to 7 layers of loosely arranged, stomata more on the lower surface stomatal index on upper surface, 9 to 12, and lower surface 11 to 17.

Fruit –

Shows several ridges in outline; epicarp consists of single layered epidermis covered externally with thick cuticle; mesocarp consists of polygonal, thin walled parenchymatous cells having pathes of sclerenchymatous cells on both lateral side; endosperm and embryo composed of oval to polygonal, thin-walled parenchymatous cells¹.

Powder –

Green to greenish-brown, shows fragments of the epidermal cells polygonal in surface view with stomata, palisade cells, vessels with spiral, reticulate and annular thickening; microspenoidal and rossete crystals of calcium oxalate; simple, oval to round starch grains¹.

Identity, Purity and Strength

Foreign matter	- Not more than 2 percent
Total ash	- Not more than 17percent
Acid-insoluble ash	- Not more than 5 percent
Alcohol-soluble extractive	- Not more than 9 percent
Water-soluble extractive	- Not more than 20 percent

Chemical Constituents

It contains glycosides such as asiaticoside, medacassoside, brahmoside, brahminoside and a new triterpine glycoside – thankuniside. It contains alkaloids such as hydrocotylin and vellarine. It contains new triterpine acid – thankunic acid, anthrone of asiaticoside, asiatic acid, madegascaric or madecassic acid, isothankuniside and brahmic acid, centelloside, centic acid, centellic acid and centoic acid, indocentoic acid, indocentelloside and new oligosaccharide centellose¹⁻².

Pharmacological Activities

Antiprotozoal, spasmolytic, alternative, astringent, anti-inflammatory, antifertility, sedative, CNS

depressant, antitubercular, antileprotic, hepatoprotective, antispasmodic, antiamoebic, hypotensive¹.

Toxicology

Subcutaneous injection of asiaticoside in doses of 0.04 to 0.05 gm / kg in rat and rabbit was found toxic. The oral dose of 1 gm / kg was well tolerated. Contact dermatitis has been observed due to Madecassol (an extract of *Centellaasiatica*). Triterpene glycosides have been identified as having oncogenic activity and asiatico side has been implicated as a passible carcinogen on repeated application¹.

Therapeutic evaluation

The result of the double blind trial of the Mandookaparni on mentally retarded children showed a very significant increase in both general ability and behavioural pattern when the drug was administrated even for a short period of 12 weeks. It produced a significant improvement and behavioural changes².

Substitutes and Adulterants

Centellaasiatica and Bacopamonnieri (Linn.) pennell often get substituted for each other in the market as both are commonly sold under the same vernacular name, Brahmi. But Ayurvedic texts and related literature are clear in mentioning the name Brahmi to the Bacopamonnieri. Comparative anatomical features can differentiate two species. Chemically both species are rich in saponins. Madecassoside and asiaticoside are important saponins of *Centellaasiatica* whereas Bacopamonnieri contains bacoside A and bacoside B².

Uses

The plant is bitter, acrid, sweet, cooling, soporific, cardi tonic, nervine tonic, stomachic, carminative, antileprotic, diuretic and febrifuge. It is useful in insomnia, cardiac debility, epilepsy, laryngitis, asthma, bronchitis, hiccough, abdominal disorders, leprosy, strangury and fever. It has been found to be useful in diseases of skin, nerves and blood. Leaves are useful in abdominal disorders due to the dysentery in children. They are also used as tonic and for improving memory, useful in syphilitic skin diseases both internally and externally².

Ayurvedic properties

Rasa	-	<i>Tikta, Kashaya, Madhura</i>
Guna	-	<i>Laghu, Sara</i>
Veerya	-	<i>Sheeta</i>
Vipaka	-	<i>Madhura</i>
Prabhava	-	<i>Medhya</i>

Doshagnata	-	<i>Tridoshasamaka</i>
Rogagnata	-	<i>Apasmara, Unmada, Grahani, Shotha, Kasa, Shwasa, Prameha, Kushtha, Phiranga, Daurbalya</i>
Karma	-	<i>Medhya, Rasayana, Swarya, Hridya, Kushthaghna, Amapachana, Mootrajanana, Baly</i>

Doses:

Leaf juice - 10-20 ml

Powdered drug – 0.5 gm thrice daily for leprosy

Brahmi Ghrita – 5 -10 ml two times a day

Ashtanga Ghrita - 5 -10 ml two times a day

Dry Herb – 0.33 – 0.68 gm

Dry extract 10:1 – 0.035 – 0.070 gm

Liquid Extract IPC – 0.12 – 0.3 ml

Pulvis (with sucrose) – 0.5 – 0.1 gm

Storage: To be stored in the air-tight containers in a cool and dark place.

Marketed product of mandukaparni:

- Mandukaparni Churna (Gotu Kola Powder), organic by **Classic Ayurveda**.
- Mandukaparni (Centella asiatica) / Gotu Kola Capsule by **Licensed Natural Health Product**.

DESCRIPTION OF THE PHARMACOLOGICAL ACTIVITIES:**Cardiovascular activity:**

A three week treatment of a triterpene fraction of *Centellaasiatica* in the clients with postphlebotic system has been reported to reduce the number of the circulating endothelial cells, as compared to the normal subjects³.

Antioxidant activity:

The administration of the asiaticoside, an isolated constituent of *Centellaasiatica*, has been reported to significantly increase the levels of the superoxide dismutase, catalase, glutathione peroxidase, vitamin E and ascorbic acid in excision-type cutaneous wounds in rats. The level of the antioxidant activity has been reported highest during the initial stages of the treatment⁴. It has been reported that *Centellaasiatica* acts as a potent antioxidant and proved efficacious in protecting the rat brain against age related oxidative damage⁵.

Antimicrobial activity:

The essential oil of the *Centellaasiatica* has been reported to shown a broad spectrum of the antibacterial activities against gram–positive (*Bacillus subtilis*, *Staphylococcus aureus*) and gram

– negative (*Escherichia coli*, *Pseudomonas aeruginosa*, *Shigella sonnei*) organisms. Activity against gram-positive bacteria has been reported greater than against gram-negative bacteria. Geramacrene compounds in the essential oil have been reported to be the strong antimicrobial and antitumor agents⁶. Asiaticoside has been reported to be active against mycobacterium tuberculosis, *Bacillus leprae* and *Entamoeba histolytica*⁷.

Antifilarial activity:

A mixture (1:1) of the ethanol extracts from the leaves of *Centella asiatica* and the funicles of *Acacia auriculiformis* has been administered orally to pariah dogs naturally infected with *Dirofilaria immitis* at 0.04 mg/g body weight/d for 45 days. Two triterpenoid saponins, acaciaside A and B, isolated from the funicles of *A. auriculiformis* has been combined with the leaf ethanol extract from *C. asiatica* (1:1) and has been tested at 0.04 mg/g body weight/d for 45 days on microfilaraemic dogs. There was an initial fluctuation in the microfilarial (mf) count in the blood following treatment with the mixture of crude extracts, and then the mf density decreased up to 99%. This suppression lasted for 120 days⁸.

Anxiolytic activity:

The ayurvedic medicinal plant Gotukola (*Centella asiatica*) has been evaluated for its anxiolytic properties. Specifically, this study assessed the effects of: Gotukola plant materials of different genotypic origin; hexane, ethyl acetate and methanol extracts of Gotukola; and asiaticoside, a triterpenic compound which has been isolated from Gotukola. Various paradigms has been used to assess the anxiolytic activity, including the elevated plus maze (EPM), open field, social interaction, locomotor activity, punished drinking (Vogel) and novel cage tests. The EPM test revealed that Gotukola, its methanol and ethyl acetate extracts as well as the pure asiaticoside, imparted anxiolytic activity. Furthermore, the asiaticoside did not affect locomotor activity, suggesting these compounds do not have sedative effects in rodents⁹.

Antidiabetic and antihyperlipidemic activity:

This study has been undertaken to determine the effect of *Centella asiatica* aqueous extract (CAEt) on nociception, experimental diabetes and hyperlipidemia in mice and rats. The extract has been administered orally and the effects of different doses of the extract on nociception in mice, on blood glucose, glucose-6-phosphatase, and serum and tissue lipids in rats with alloxan-induced diabetes has been studied. Diclofenac and chlopropamide has been used as standard drugs for nociception and diabetes, respectively. The doses of extract administered has been used as 150, 300, 500 mg/kg body weight. The data obtained indicated that the aqueous extract of *Centella asiatica* has exhibited anti-nociceptive activity in mice. Results of the anti-diabetic study

indicated that the extract suppressed the elevated blood glucose. In anti-hyperlipidemic study, lipid levels change in diabetic rats treated with CAEt¹⁰.

Radioprotective activity:

The effects of low-dose whole-body ⁶⁰Co gamma-irradiation in male rats has been studied in terms of body weight and CTA learning. For CTA, the consumption of saccharin solution has been considered as a parameter. To protect against the adverse effects of radiation, *Centellaasiatica* (aqueous extract) has been tested and compared with ondansetron, a standard antiemetic drug. A dose of 2 Gy incurred significant body weight loss [t(9)=9.00, P<.05] and induced CTA in rats [t(26)=9.344, P<.01]. Administration of *C. asiatica* (100 mg/kg bwip, 2 Gy, -1 h) has been rendered significant radioprotection against radiation-induced body weight loss and CTA that became evident on the second post-irradiation day [t(7)=0.917, P>>.05; t(7)=4.016, P>.05]. Ondansetron (1 mg/kg bw) elicited higher degree of protection against CTA [t(7)=3.641, P>.05] than *C. asiatica* [t(7)=7.196, P>.05] on the first post-irradiation day, but on the second postirradiation day, both has been reported to be equally effective [t(7)=3.38, P>.05; t(7)=4.01, P>.05]. In case of *C. asiatica*-treated animals, however, there has been a consistently declining CTA from the second to the fifth post-irradiation day whereas in ondansetron-treated animals it has been reported inconsistent. Present investigation suggests that *C. asiatica* could be useful in preventing radiation-induced behavioural changes during clinical radiotherapy¹¹. Modulatory effect of *Centellaasiatica* on the alkaline phosphatase activity on the mouse liver after whole body gamma irradiation has been reported¹². Effect of the *Centellaasiatica* on the intestinal goblet cells after irradiation to gamma rays in mice has been investigated¹³.

Antiproliferative activity:

The antiproliferative constituents in the methanolic extract from the aerial parts of *Centellaasiatica* (Umbelliferae) has been investigated. Activity-guided fractionation of the methanolic extract has been resulted in the isolation of the ursolic acid lactone, ursolic acid, pomolic acid, 2alpha, 3alpha-dihydroxyurs-12-en-28-ioc acid, 3-epimaslinic acid, asiatic acid, corosolic acid and rosmarinic acid. Antiproliferative activity of the isolated compounds against human gastric adenocarcinoma, human uterine carcinoma and murine melanoma cells has been estimated¹⁴. Asiatic acid and asiaticoside of *Centellaasiatica* has been reported to inhibit the proliferation of coronary smooth muscle cells¹⁵. In vitro keratinocyte antiproliferative effect of *Centellaasiatica* extract and triterpenoidsaponins has been reported¹⁶.

Anticonvulsant activity:

Centellaasiatica extract has been reported to exhibit significantly anti-convulsant activity against

hypoxia induced convulsions (generalized tonic and clonic) and lithium-pilocarpine induced status epilepticus (forelimb clonics with rearing) along with the potent antioxidant¹⁷.

Memory enhancement activity:

Leaves of *Centellaasiatica* has been used along with some other herbs as medhya drugs for the memory enhancement and as promoter of the strength and digestive power. It has been reported that there has been established a relationship between two properties of this plant. That is, special learning and memory enhancing property & its effects on overall body weight growth on neonatal and adult rats¹⁸. Rats treated with *Centellaasiatica* has been reported to show a dose dependent increase in cognitive behaviour in the streptozotocin model of Alzheimer's disease¹⁹. *Centellaasiatica* fresh leaf aqueous extract has been reported to increase biogenic amine turnover in the albino rats and has a positive effect on the learning and memory²⁰.

Antinociceptive and anti-inflammatory activity:

Administration of *Centellaasiatica* extracts has been reported to show significant antinociceptive activity in hot-plate and acetic acid induced writhing tests in mice and rats²¹. Bioactive terpene acids such as asiatic acid and madecassic acid from water-methanol extraction of *Centellaasiatica* has been account for antinociceptive and anti-inflammatory activities²². Madecassol (asiaticoside) has been reported to reduce acute skin reactions in radiotherapy-treated rats²³.

Antiulcer activity:

Extract of *Centellaasiatica* (Linn.) has been reported to inhibit significantly gastric ulceration induced by the cold restraint stress in Charles-Foster rats. Anti-ulcer activity has been compared with the famotidine (H₂-antagonist) and sodium valproate (anti-epileptic). Plants extract increased the brain GABA level which has been reported as dose dependent²⁴.

Antitumor activity:

Purified fraction of the *Centellaasiatica* has been reported to act directly on the DNA synthesis as suggested by trituated thymidine, uridine and leucine incorporated assay and has anti-tumor activity²⁵.

Wound healing activity:

Titrated extract of the *Centellaasiatica*, consisting of the mixture of three triterpenes (asiatic acid, madecassic acid and asiaticoside) stimulates collagen and glycosaminoglycan synthesis in rats surgically inserted with stainless steel wound chambers²⁶. In the treatment of keloids, madecassol (asiaticoside) compares favorably with compression bandaging and provides more lasting results than intralesional cortisone or radiation therapy²⁷.

Autoimmune activity:

The usage of madecassol (asiaticoside) in the tablet, ointment and powdered form has been reported to be efficacious in the treatment of the chronic or sub-chronic systemic scleroderma with limited skin involvement, and in progressive or advanced focal scleroderma²⁸.

CONCLUSION:

The Mandukaparni is bitter, acrid, sweet, cooling, soporific, cardiogenic, nervine tonic, stomachic, carminative, antileprotic, diuretic and febrifuge. It is used as a brain tonic for promoting brain growth and improving memory. Ayurvedic medicines has effectively used it in the treatment of inflammation, anemia, asthma, blood disorders, bronchitis, fever, urinary discharge and splenomegaly. Reported activity of *Centellaasiatica* are cardiovascular activity, antioxidant activity, antimicrobial activity, antifilarial activity, anxiolytic activity, antidiabetic and antihyperlipidemic activity, radioprotective activity, antiproliferative activity, anticonvulsant activity, memory enhancement activity, antinociceptive activity, anti-inflammatory activity, antiulcer activity, anti-fertility activity, antitumor activity, wound healing activity and anti-immune activity.

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